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TITLE: Production of template with macro-nanometer sequential holes involves forming large-area ordered pattern followed by anodic oxidation

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BASIC-ABSTRACT:

NOVELTY - Large-area ordered pattern is formed on surface of aluminum metal, aluminum alloy or single-crystal aluminum substrate, and then anodic oxidation is used to form large-area ordered nanometer orifice template on the substrate.

ADVANTAGE - The present invention can produce nanometer orifice template with

high-density large-area hexagonal symmetrical ordered long orifice, and it can
also produce ordered nanometer pipe, bar, etc..

TITLE-TERMS: PRODUCE TEMPLATE MACRO SEQUENCE HOLE FORMING AREA ORDER PATTERN
FOLLOW ANODE OXIDATION

DERWENT-CLASS: M11

CPI-CODES: M11-E;

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Claim

1. the method of preparation of the orderly hole template of jumbo size nanometer characterized in at first generating an orderly pattern of large tracts of land on the surface of metallic lead, aluminum alloy or single crystal aluminium, and reuse anodic oxidation method generates orderly nanometer hole template by a large scale on aluminium or aluminum alloy.

2. by the method of preparation of the said orderly hole template of jumbo size nanometer of claim 1, characterized in that the anodic oxidation generates the orderly nanometer hole template of large tracts of land, and the diameter of the effect regulation hole through reaming liquid.

3. by the method of preparation of the said orderly hole template of jumbo size nanometer of claim 1, characterized in doing basement, direct anodic oxidation with single crystal aluminium.

4. by the method of preparation of the said orderly hole template of jumbo size nanometer of claim 1, characterized in that the orderly pattern of large tracts of land the orderly pattern of hexagonal symmetry large tracts of land nanometer; Its formation method is with carbomorphism silicon, monocrystalline silicon or mother board of other materials preparation, is the hexagonal symmetry ground even nanometer cylinder of diameter that is distributing on the board, covers one deck macromolecular material membrane on the smooth aluminium base end, presses the certain pressure of mother board utilization on the macromolecular material, and the rising temperature makes the polymer soften, and the reduction of temperature makes polymer solidification again, removes the mother board, at the pattern of the macromolecular material of the orderly hole figure of smooth aluminium surface formation.

5. by the method of preparation of the said orderly hole template of jumbo size nanometer of claim 1, characterized in that the orderly pattern of large tracts of land the orderly pattern of hexagonal symmetry large tracts of land nanometer; Its formation method covers the one deck slushing compound on smooth aluminium base basal surface; Utilize photetch and mask to form orderly hole pattern on the slushing compound or utilize electron beam technique at quarter to carve out the orderly hole of hexagonal on the slushing compound.

6. by the method of preparation of the said orderly hole template of jumbo size nanometer of claim 1, characterized in that the orderly pattern of large tracts of land the orderly pattern of hexagonal symmetry large tracts of land nanometer; Its formation method covers the one deck slushing compound on the smooth aluminium base end, adopt the coherent light to make the light source, utilizes optical interference exposure technique to form the orderly figure of nanometer of hexagonal symmetry by a large scale on the resist layer, through the developing treatment, obtains the orderly pattern of hole of hexagonal symmetry.

7. by the method of preparation of claim 1,2 said orderly hole templates of jumbo size nanometer, characterized in that the condition of anodic oxidation; Voltage connects the aluminium of anodic oxidation from 5V to 2000V, the positive pole of power, and the what conductive electrode is taken over to the negative pole, and the time of anodic oxidation is

at 1min to 1800min.

The method of preparation of the orderly hole template of jumbo size nanometer

The invention relates to the method of preparation of the orderly hole template of method of preparation, especially jumbo size nanometer of the orderly hole of nanometer.

The orderly hole template of jumbo size nanometer can have fine application, for example, is used for novel magnetic recording dish base etc.. Present moulding-die technique, photoetching and electron beam sculpture technique can obtain the orderly hole template of large tracts of land nanometer, but can not obtain the even nanometer hole of longer diameter. Direct anodizing can only obtain the orderly nanometer hole template of small size.

The purpose of the invention is: propose the method of preparation of the orderly hole template of jumbo size nanometer, obtain the orderly hole template of large tracts of land nanometer, and obtain the even nanometer hole of longer diameter. The purpose of the invention still provides a processing cost and hangs down, and technology is reliable, and the degree of depth of nanometer hole is controlled easily, does benefit to the method of preparation of industrialization large-scale production.

The purpose of the invention realizes like this: the method of preparation of the orderly hole template of jumbo size nanometer, at first generates an orderly template of large tracts of land on the surface of metallic lead or aluminum alloy, utilizes the anodic oxidation technique on this basis, generate the orderly nanometer hole template of large tracts of land on aluminium or aluminum alloy, and hole length is longer. Perhaps utilizing single crystal aluminium to do the basement, having eliminated the influence of grain boundary in the polycrystal aluminium, direct anodic oxidation generates the orderly nanometer hole template of large tracts of land, and the diameter of the effect regulation hole through reaming liquid. Thereby form the orderly hole template of jumbo size nanometer.Do the basement with single crystal aluminium, eliminated the influence of grain boundary in the polycrystal aluminium, so can direct anodic oxidation.

The characteristics of the invention are: the invention can produce the nanometer hole template in the orderly slot hole hole of high density large tracts of land hexagonal symmetry, and when this kind of template was used as orderly magnetic recording medium, the packing density can reach per square inch 170G, and is higher even. This kind of template also can be used for preparing orderly nanotube, and the orderly nanometer of growing is excellent, can also regard as the carrier of catalyst. Two kind ready-made techniques are fused to the method of the invention that the main is, the processing cost is low, and technology is reliable, and the degree of depth of nanometer hole is controlled easily, does benefit to industrialization large-scale production.

Followingly further explain the invention according to figure and embodiment:

The photo that Fig. 1 provided for the invention, the size is marked on the photo.

The specialization of invention method: three step is divided to the embodiment of the orderly hole template of preparation jumbo size nanometer on metallic lead or aluminum

alloy, and the first step produces the orderly figure of hexagonal symmetry large tracts of land nanometer; The step-by-step capable electrochemistry anodic oxidation of second, the diameter of hole is adjusted to the third step through the effect of reaming liquid.

The first step has three kinds of schemes,

1. with carborundum, monocrystalline silicon or mother board of other materials preparation, be hexagonal symmetry ground on the board and distribute

The even nanometer cylinder of diameter. Cover the one deck high score in smooth aluminium (or aluminum alloy) basement

Sub- material membrane (like PMMA) can also use polyester film etc., with the certain pressure of mother board utilization

The pressure is on the macromolecular material, and the rising temperature makes the polymer soften, and the reduction of temperature makes polymer solidification again.

Remove the mother board, at the surperficial polymer that forms orderly hole figure of smooth aluminium (or aluminum alloy)

The pattern of material.

2. make the mask that has the even pattern of diameter of the orderly distribution of hexagonal symmetry. Smooth aluminium (or

The aluminum alloy), covers one deck slushing compound (with above-mentioned, like PMMA) on the substrate surface. Utilize the photoetching

Technique (like the ultraviolet photoetching, X ray photoetching etc.) and mask form orderly hole picture on the slushing compound

The case. Or utilize electron beam technique at quarter to carve out the orderly hole of hexagonal on the slushing compound.

3. cover the one deck slushing compound in smooth aluminium (or aluminum alloy) basement, adopt the coherent light to make the light source, it is sharp

The nanometer that forms the large tracts of land hexagonal symmetry with optical interference exposure technique on the resist layer is schemed in order

Shape. Through the developing treatment, obtain the orderly figure of hole of hexagonal symmetry, 3 kind above-mentioned methods all are

Have the technique, the technology of being applied to the invention does not have specific requirement, for example, can see: Appl.Phys.

Lett, 1995,67 (21) P3114-3116 Stephen Y.Chou et.al.Imprint of sub-25

Nm vias and trenches in polymers

The second step: anodic oxidation: on the basis of above-mentioned figure, utilize the electrochemistry anodic oxidation to select suitable electrolyte and oxidation voltage, can generate the orderly nanometer hole preface template of large tracts of land on aluminium (or aluminum alloy), and the length in hole is longer.

According to the hole of produced figure distance in the heart, select suitable electrolyte and DC voltage to carry out the anodic oxidation. 5V to 2000V is followed like: 0.1 to 2.0M sulphuric acid, oxalic acid, phosphoric acid etc., decomposition voltage to electrolyte, and the positive pole of power connects the aluminium of anodic oxidation, and the what conductive electrode is taken over to the negative pole. The time of anodic oxidation is at 1min to 1800min. In the embodiment, use 0.4M sulphuric acid, decomposition voltage from 25V, the positive pole of power connects the aluminium of anodic oxidation, and the what conductive electrode is taken over to the negative pole. The time of anodic oxidation is at 1200min. During decomposition voltage 100V, the time of anodic oxidation is at 10min.The time of anodic oxidation treatment is the prior art with the relation of voltage.

Third step reaming:

When the aperture of anodic oxidation missed the size, the third step was necessary. Utilize 0.1 to 5.0M phosphoric acid, hydrochloric acid etc., the embodiment is the phosphoric acid of 0.3M concentration. Increase macroporous diameter under suitable

temperature, controlled temperature and reaming time can obtain required aperture. The moisture content control is 30 DEG Cs in the embodiment, and the reaming time is 20 minutes, and the aperture is 30nm in the embodiment. In fact, the hole the diameter 10nm to 500nm all can, and be used for the magnetic recording material the aperture generally can about the 30nm. Utilize the acidizing fluid reaming, sour concentration has certain relation with temperature, operational time and hole diameter, and it is long that generally speaking, sour pH value is littleer, the temperature heals the height, the operational time is healed, and the diameter in hole is just healed greatly.

Utilizing the orderly template of single crystal aluminium preparation large tracts of land nanometer, not needing above-mentioned first step, two steps are the same at the back.

The size of the invention can be selected, generally reaches several square centimeters easily, and this just has very broad practical prospect. Another embodiment of the invention is, selects piece type monocrystalline silicon, aluminium, aluminum alloy piece for use, combines with the basement or the substrate material of other materials behind the preparation finished product again, is more convenient for lowering costs the practicality of being convenient for.

The photo is the technology embodiment in 30nm aperture, and the photo has provided good growth effect.